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SCIENCE AND TECHNOLOGY IS THE SOLUTION OF AFRICA'S LONG-TERM DEVELOPMENT PROBLEMS

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Introduction

1. Universities are reported to have existed in Africa in ancient times (1, 2, 3) but the institutions of higher learning under discussion in this paper are of more recent origin. Most of them were founded in the 1960s or later, following the independence of their respective countries. Independence brought with it fresh hopes, challenges and pledges for pursuing self-sustained and self-reliant socio-economic development. Education was seen as a major factor in strengthening each country's development strategiest through the production of trained manpower to spearhead the modernization of agriculture, health services, industry etc and to assist each country's participation in the collective development of the African continent.

2. The Conference of African Ministers of Education of the Independent states of Africa held in Addis Ababa in 1961 made a declaration which summed up the aspirations of the time as follows:

> "The citizens of Africa see in education a means by which their aspirations may be met. They are willing to sacrifice for the attainment of this means for gaining economic and social development". (4)

3. A year later the Ministers of Education met in Tananarive, Madagascar and produced far-reaching plans for the relatively young universities and for the others which were to be established in the next 20 years.(5)

4. As a consequence of these declarations all countries invested heavily in education and the large enrolments in the primary and secondary levels, in the post independence years testify to society's acceptance and belief that education is a vehicle to a better life. In some cases governments have attempted to limit expansion, but the social and political pressures to build more schools have been insurmountable. These factors give education a special place among the agents for propelling socio-economic development and impose tremendous responsibility on educators and educational institutions responsibility on educators and educational institutions to deliver the kind of education which answers the aspirations of the people.

5. Over the years educators and politicians alike have analysed the tole of higher education in Africa. Nkwame Nkrumah [6] Nnamdi Azikiwe [7], Julius Nyerere [8], Seretse Khama [9] and many others have pronounced strongly and repeatedly on the nature and relevance of higher education, the character of the institutions of learning and their relationship to the environment that surrounds them. The University "must be in and of the community in which it has been established" [1] is a theme that dominated every political leaders pronouncement.

6. "Creating an African University" was the theme of the ECA/AAU Workshop held in Accra, Ghana in 1972 at which six major functions of a "truly African University" were formulated [1]. These functions represented what academics and Heads of Universities perceived as the desired contributions of their institutions to African development. Subsequent workshops have not only reiterated those functions but have also expresed concern with the apparent failure of universities to reflect the needs of their communities in their programmes and activities.

7. A question might however be asked: What kind of communities have existed in Africa in the past 3 decades, whose aspirations and conditions higher education should have been designed to serve?

8. Since the founding of the universities in the 1960s, Africa has continued to undergo drastic changes in every sphere of human existence. The recent history of Africa has been characterised by protracted struggles to assert the African initiative and identity. Traditional life has been subjected to numerous religious, political, economic and scientific theories and experiments originating from every corner of the globe which African politicians and educators have accepted and even promoted. Agriculture, health and industry continue to be subjected to innovations which are supported by massive international aid. Educational reforms have been proposed and implemented but none seem to have made a significant impact on the development process. The current situation is well summed up in the preamble of the Lagos Plan of Action where African Heads of States and Government openly declare that "Africa is unable to point to any significant growth rate or

satisfactory index of general well-being in the past 20 years" (10). Since 1980 the situation has continued to worsen so that the recent document, "Africa's Priority Programme for Economic Recovery 1986 - 1990" portrays an even bleaker future for the continent (11). The present picture is one of domestic and intercountry conflict, drought, desertification, starvation, rampant disease and malnutrition, corruption in high places, a heavy debt burden, high unemployment especially amont the youth.

9. Many questions on the causes of the failure to realize the dreams of independence have been asked. The answers are many and varied and include disruptive colonial influence, misapplication of western models of political institutions to indigenous structures, limitations of planning processes, lack of identity and pride derived from the uniqueness of cultures etc. (12).

10. Universities have also been affected by the same forces which have shaped the course of the events and precipitated the present crisis. The effects are evident in the shortage of funds to purchase books, journals and research equipment and in the migration of staff from their institutions to other parts of Africa or to industrialized countries in search of greener pastures. In addition confrontation between governments and universities has become a common occurrence and has tended to hinder dialogue on how higher education can best serve the interests of each country.

11. It would be overly optimistic to predict a sudden reversal of the problems so that any proposed strategies for their solution must be long term, multifaceted and involve all educational institutions in the continent. The functions of the university as laid down at the Accra workshop in 1972 (1) are more valid now that ever before and compliment the programmes outlined in the Lagos Plan of Action (10). In order to carry out these functions under the prevailing conditions, universities will have to adopt policies and strategies which will enable them to work in the midst of turmoil and adversity.

Science and Technology in Africa

12. The problems of Africa are too complex for one to provide simple analyses and straightforward remedies. Nevertheless the discussion should concentrate on how universities can assist the continent in designing fresh approaches for the use in science and technology. In the Lagos Plan of Action, a whole chapter is devoted to science and technology as a means of "raising African standards of living and relieving misery in the rural areas". The Plan recognizes the inter-sectoral nature of science and technology and proposes measures to ensure their adequate application in all sectors of human endeavour. Debates on science and technology which have dominated international fora in recent times have been spurred by the realization that industrialized countries have harnessed science and technology to advantage in every sector of their economic activities. It was honed that similar patterns of development would be achieved in the Third World.

13. A review of regional meetings starting with the UNESCO/ECA "International Conference on the Organization of Research and Training in Africa in relation to the Study, Conservation and Utilization of Natural Resources" held in Lagos in 1964 (13) shows that African States were concerned very early in their independence with the application of science and technology to development. They recognized that it was essential to have indigenous capacities to take control of industrial development, to make appropriate choices of technology and to unpackage important technology and to engage in research and development (R and D) activities or relevance to the needs of each country (14). The Conference of Ministers of African States responsible for the Application of Science and Technology (CASTAFRICA) held in Dakar in 1974 (15) made specific recommendations on the numbers of scientists and engineers and, the levels of investment in R and D etc., which were necessary for the successful application of science and technology. While some progress has been made, especially following the United Nations Conference on Science and Technology for Development held in Vienna in 1979, much still remains to be done in Africa. It is in fact correct to say that although science and technology are acknowledged as vital to development their successful application at the practical level remains elusive.

New Developments in Science and Technology

14. While the continent is struggling to define the proper usage of science and technology, industrialized countries have continued to advance so rapidly that they are now said to be undergoing another "industrial revolution". The new technologies, biotechnology, materials technology, and microelectronics all promise to change the lifestyles of all countries producing them. These developments pronounce doom for Africa. For example, biotechnology could seriously undermine the export position of non-agricultural products important to a number of countries. Microelectronics could reverse the comparative advantage of cheap labour which in the past induced transnational corporations to locate industrial production units in Africa. However the computer-assisted technological advances are changing communication and information systems, with great potential for developing countries. Solar energy and energy from biogas are likely to be beneficial to African countries but they require national capabilities to spell out their advantages (12).

15. The potential impact of the new technologies is expected to be so serious and far reaching that the OAU/ECA organized a meeting of experts to consider the implications of the new technologies on the Lagos Plan of Action in Mbabane in 1984. (16) These organizations, collaborating with other international agencies have also initiated a project on the design of an early-warning system to alert African governments on technological developments which might be adopted to advantage or which might adversely affect their countries.(17)

16. How can universities assist the continent design fresh and appropriate approaches for the use of science and technology in the solution of its dauting problems? There are several issues which universities can address in this context.

1. Building an African framework for Science and Technology

The scientific and technological advances mentioned earlier are being adopted at a fast rate by the newly industrializing countries of Asia and Latin America. This factor is changing the nature of international debates, and making issues of serious concern to Africa obsolete to countries which are now preoccupied with a future which will be dominated by sophisticated technologies. It has become crucially important for Africans to internalize the debate in order to provide the continent with its own framework on which to build long-term strategies for utilizing science and technology. For example the new technologies have a two-fold potential for countries in Africa. Their negative effects have a potential to accelerate development, the so called "leap-frogging", (23) If adopted with a clear appreciation and understanding of the African condition.

Universities often have the highest concentration of scientists, engineers and others in science based disciplines, in each country. These experts have a major role to play by examining the potentials of the technologies and proclaiming the possibilities to both governments and the general public. It is incumbent upon those who have scientific training to initiate and sustain the effort until a consesus is reached on what is important for African development.

2. The Undergraduate Programmes

It is usual to blame the educational system for the many problems facing our continent. However it must be admitted that the complexity of Africa's problems demands multi-disciplinary approaches coupled with a knowledge of continental and global affairs. It is not time for natural science and other science based disciplines to consider introducing courses on African and global affairs in their regular programmes, in order to sensitize students to social issues, especially those involving science and society. Several universities are already doing this and their courses could provide a basis for further curriculum development.(24)

It is also evident that the unemployment of graduates will become a major concern in the future. Much of the unemployment of youth has been attributed to the nature of our educational systems and their aims, because most institutions train people for vacancies in government and in the private sector. While this was necessary after independence when vacancies were abundant, there is now need for all disciplines to include in their teaching some course on "enterpreneurship" in order to prepare graduates for the possibility of being unemployed.

3. Research

Every university regardless of size and age emphasizes the need for staff in all disciplines to undertake research. The funding of research varies from institution to institution but generally research funding is low in Africa compared to other regions of the world. It is reported that Africa spends only 0.4% of the World's total financial resources committed to R and D or only about 10% of what the other developing countries as a whole in R and D (15). It is important therefore for African scientists to use these meagre resources carefully by selecting research areas which address national problems. Examples of important areas are the exploitation of natural resources, control of the many tropical diseases, increase of food production, upgrading of traditional scientific and technological knowledge.

17. The AAU/ECA are currently mobilizing subregional groups of scientists in order to find ways of applying science and technology in specific areas which are important for the continent's economic recovery (18). University scientists must get thoroughly involved in this exercise by addressing the concerns through their research activities.

4. Traditional Science and Technology

There are many useful traditional practices especially in agriculture and medicine but one cannot really speak of an organized body of knowledge which can be taught to students. The broad general question which has been asked is what constitutes traditional science and technology? If Africans cannot answer this question the recognition and credibility of vast amounts of knowledge will be hampered and more serious perhaps, the importation of western alternatives will continue to block the development of innovative capacities among African scientists (19). For example traditional medicine continues to

be used by over 50% of the population of many countries. Various universities in Africa have research units in this field while the OAU/STRC has formed an Inter-African Committee on Medicinal Plants and Traditional Medicine (20). This area has a vast potential for expanding primary health care and in the overall strategy for ecological conservation and in the preservation of genetic diversity(21). The socio-cultural aspects are also important particularly as they relate to belief systems which govern people's reactions and attitudes.

A diploma course for practitioners of traditional medicine to provide them with a scientific background could provide a real challenge to professors of science, medicine and pharmacy, during the curriculum design stage. It would also constitute one way of organizing traditional science and technology. Similar examples can be drawn from agriculture.

Scientific and Technological Information

There are vast quantities of information accumulated through the activities of United Nations agencies such as the United Nations Centre for Science and Technology for Development, (UNCSTD), Food and Agricultural Organization (FAO), United Nations Industrial Development Organization (UNIDO) and others. But who is going to determine what is useful and appropriate for use in the strategies for economic recovery of Africa? In my view, African scientists cannot escape this responsibility if a useful agenda for the use of science and technology in the solution of long-term problems is going to emerge.

5. Scientific Communication

Some of the preceeding suggestions assume a general awareness of the importance of science and technology in development among the policymakers, the general public and among the scientists themselves.

The suggestions also assume that scientists have access to the decision-making process in order to influence national policies and strategies. Both assumptions are not true in many cases. Therefore one of the major activities of university scientists must be to communicate the importance of their work to the general public through scientific literacy campaigns. Odhiambo states that "technological skills cannot flourish in a human environment which is not sympathetic to scienct" (22).
The so called "popularization of science and technology" must become part of the regular activities of natural sciences and other science based faculties.

Consultancies

18. One of the major problems of the African scientific and technological effort is the reliance of governments of foreign expertise and consultants. Universities must set up consultancy centers on modest or grand scales commensurate with the size and disciplines available among staff of a particular university. In this respect the example of the Technology Consultancy Centre of the University of Science and Technology in Ghana needs to be emulated. (24) Where the "critical mass" of scientists is lacking subregional and regional university groups could be considered. The practice of inviting external consultancies must be challenged by groups of African experts organizing themselves and soliciting recognition from governments and international agencies.

Recommendations

19. In the light of the above exposition the following recommendations appear to be appropriate:

1. The AAU, ECA and OAU should mobilize resources to enable groups of scientists to meet and reflect on the problems under discussion and to propose solutions. Such meetings should involve policy-makers.

2. The AAU should sponsor the organization of meetings of Deans and Heads of Science, Agriculture Medicine, Pharmacy etc. to familiarize them with the ECA/OAU proposed recovery programme for the continent. This will stimulate interest and new ideas on curriculum reform and on the re-orientation of research activities.

3. Universities must encourage the setting up of consultancies in their Faculties of Science, Engineering etc. as a way of cultivating national advisory capacities which may gain recognition in due course.

4. Universities must encourage staff to undertake out-of-class activities such as scientific literacy campaigns and recognize these among the criteria for academic staff promotions.

5. National governments should provide their universities with generous research budgets in order to encourage the kind of research necessary for the solution of development problems.

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